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Solution by the PROPOSER.

$r(a^2\sin^2\theta+b^2\cos^2\theta)=2ab^2\cos\theta$ or $u=\dfrac{a^2\sin^2\theta+b^2\cos^2\theta}{2ab^2\cos\theta}$ is polar equation to the ellipse with vertex as pole.

$F=h^2u^2\left(\dfrac{d^2u}{d\theta^2}+u\right)$ is the force required, h being an undetermined constant.

$$\frac{d^2u}{d\theta^2}=\frac{(a^2-b^2)\cos^4\theta+a^2\sin^2\theta+a^2}{2ab^2\cos^3\theta}; \quad \frac{d^2u}{d\theta^2}+u=\frac{a}{b^2\cos^3\theta}.$$

$$\therefore F=\frac{ah^2u^2}{b^2\cos^3\theta}=\frac{ah^2(a^2\sin^2\theta+b^2\cos^2\theta)^2}{4a^2b^6\cos^5\theta},$$

$$\therefore F=\frac{a^3h^2}{4b^6\cos^5\theta}-\frac{h^2a(a^2-b^2)}{2b^6\cos^3\theta}+\frac{(a^2-b^2)^2h^2}{4ab^6\cos\theta}.$$

Also solved by *J. SCHEFFER*.

99. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, Ohio.

Through the zenith of an observer at the sea-coast in north latitude $\varphi=40°$, a "cat's-tail cloud," height $h=10$ miles, extends northeast until it touches the horizon. How far from the observer is the *advance-end* of the cloud? What is the length of the cloud measured from the end specified to the observer's zenith?

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

Regarding the earth as a perfect sphere of radius 3963 miles, and disregarding the observer's height, the distance and length required will be the same for any latitude.

Let C be the center of the earth, O the position of the observer, Z his zenith, and BOA the diameter of the visible horizon.

$OA=\sqrt{(CA^2-CO^2)}=\sqrt{[(3973)^2-(3963)^2]}=281.71$ miles, the distance of advance end from observer.

$\cos OCA=\frac{3963}{3973}=.997483$. $\angle OCA=4°\,4'$.

$\therefore ZA=(4\frac{1}{15}\pi\times7946)/360=281.99$ miles, length of cloud.

100. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, O.

Determine the maximum value of $(\varphi-\varphi')$, if given electric currents C and C' produce deflections φ and φ' in a tangent galvanometer, so that $\tan\varphi/\tan\varphi'=C/C'$.

Solution by GEORGE R. DEAN, Professor of Mathematics, Missouri State School of Mines and Metallurgy, Rolla, Mo.

We have $C'\tan\varphi=C\tan\varphi'$, $u=\varphi-\varphi'$.